

REMARKS

Claims 1-14 were pending and considered. Claims 3-6, 12 and 13 were objected to but indicated to be allowable. Claims 1, 2, 7-11 and 14 were rejected. In response, claims 3 and 12 have been amended. Upon entry of this amendment, claims 1-14 remain pending.

Reconsideration and allowance are respectfully requested.

Response To Claim Objections

Claims 3 and 12 were objected to because of an error that entered into the claims as printed in amendments after the application was filed. The symbol " \leq ", which was found in claims 3 and 12 as filed, inadvertently was printed as "#" in subsequent re-printings of claims 3 and 12. It should be noted that in claims 3 and 12 as originally filed, the proper symbol " \leq " was present, and claims 3 and 12 have not been amended intentionally in previous documents. The error was one simply in character generation of the printed document. However, to correct the error in recent documents, claims 3 and 12 herein now show amendments whereby the symbol "#" has been changed to -- \leq --. It is respectfully submitted that claims 3 and 12 are now proper, and the objection should be removed.

Applicants gratefully acknowledge the Examiners indication that claims 3-6, 12 and 13 would be allowable if rewritten in independent form. In response, claims 3 and 12 have been rewritten and are presented herein in independent form. Accordingly, claims 3 and 12 are believed to be allowable. Since claims 4-6 depend from claim 3, and claim 13 depends from claim 12, Applicants believe that all of claims 3-6 and 12-13 are now in condition for allowance.

Specifically, claim 3 has been rewritten to include all of the limitations of claims 1 and 2, from which claim 3 depended previously. Accordingly, claim 3 is now presented in proper

independent form and should be allowed. Claims 4, 5 and 6 depend from claim 3 and therefore are in condition to be allowed without amendment.

Claim 12 has been amended to include all of the limitations of claims 10 and 11, from which claim 12 depended previously. Accordingly, claim 12 is now presented in proper independent form and should be allowed. Claim 13 depends from claim 12 and therefore is in condition for allowance without amendment.

Reconsideration and allowance of each of claims 3-6, 12 and 13 are respectfully requested.

Response To Claims Rejection

Claims 1, 2, 7-11 and 14 have been rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent 5,677,716 (Cleveland).

A. Summary of the Teachings of Cleveland

Cleveland discloses a maximum-diagonal print mask and multi-pass printing modes for a high quality and high throughput printing with liquid based inks. A problem recognized in the background of the Cleveland patent is that, to achieve vivid colors with aqueous inks, ample quantities of ink must be deposited, and subsequent removal of the water base by evaporation can be time consuming. Bleed-through, smear and paper shrinkage problems such as cockle and puckering can occur when large quantities of ink are used. Print mode variations have been used in which the ink is applied in numerous passes so that some ink drying occurs even before a specific character or image is completed. Cleveland discusses prior solutions in which so called "checker board" printing is used in which every other pixel location is printed in one pass and the unprinted pixels are filled-in during a second pass. Various other known rotating print mode

masks are discussed. Another problem mentioned in the Cleveland patent is end-of-image print-medium advance errors (column 3). As the end of a sheet is reached, rollers holding the medium taut lose control of the sheet and print quality therefore can change.

The primary focus of the Cleveland teaching is enhancing image quality throughout the medium. Cleveland proposes scanning the printhead repeatedly along a pen-scanning axis that is substantially orthogonal to a printing medium advance axis (column 10, lines 50-52). Unprinted regions are left in a first pass and are filled in subsequent passes. Heating can be used between passes to promote drying. Other aspects of the Cleveland teaching include multi-pass printing wherein at least 2 ink drops are deposited at each pixel location that is to be inked, and firing at most one third of the nozzles at any one time (column 13, lines 13-22). Cleveland's teaching for the end-of-page print defect problem is simply to advance the sheet by only half the normal advance distance as the page end is reached, and at the final printing to hold the sheet steady as multiple passes are printed.

B. Comments on Examiner's Specific Citations to the Disclosure of Cleveland

The Examiner has repeatedly referred to several sections of the Cleveland patent, about which Applicants offer the following comments:

Cleveland column 1 lines 26-36. - In this description of the field of the invention, Cleveland simply identifies that the invention described relates to printing devices for printing on different types of media, including transparency stock and other glossy media particularly with scanning thermal inkjet printing techniques. Cleveland identifies that the invention is to promote optimization of

image quality. No specific solutions, structures or techniques are mentioned in this section.

Cleveland column 3 lines 10-42. - In this section, Cleveland acknowledges the problems associated with end-of-print-medium advance errors, as the print medium is released by roller pairs that hold it taut. Reference is made to mitigating the errors by taking smaller steps in the print medium advance. However, there is no explanation of what a “smaller step” should be.

Cleveland column 13, line 66- column 14, line 59. - Discusses certain “holding –stationary” techniques during which the media is not advanced. In a brief description of the drawings, reference is made to “bottom-of-page handoff space rotation with one-sixth advance,” and “sweep rotation to enable suppression of advance of the sheet in that region.”

Cleveland column 23 lines 30-65. - This appears to be Cleveland’s primary discussion about the top/bottom of page mask rotation method. All that is proposed with respect to sheet advance is that “the print medium advance height is lowered to half (Fig. 2c) its normal midpage value (Fig. 2b).” (Column 23, lines 37-38, emphasis added). As an example, Cleveland states that in a preferred embodiment each pen has 96 nozzles creating a 96-pixel swath. The normal advance is one third, or 32 pixels. When the end of the medium is reached such that the tension cannot be maintained, the advance is halved to 16 pixels. In the final printing zone consisting of a single swath, no advance occurs.

Cleveland column 24, lines 1-13. - This passage recognizes that space rotation would require the pen to skim partly on and partly off the sheet at the end

of the page. To address this problem, Cleveland teaches changing from space rotation to sweep rotation, changing the inking pattern between pen scans. At the end of the sheet the system makes the transition to one sixth advance (from the normal one third advance, again simple a change by one-half) and only half of the nozzles print, with the mask being space rotated. When the final data is reached, advance halts and the remaining two passes are flushed out, with firmware sweep-rotating the mask.

C. Distinctions Between the Present Invention and the Teaching of Cleveland

It is respectfully submitted that Cleveland does not teach or suggest the present invention. Independent claims 1 and 10 each recite that, as the end of a page is approached, the printing method includes:

advancing the print medium in said advance direction a fixed minimum reliable move amount”.

As the term implies, the fixed minimum reliable move amount is the minimum distance that printing device can advance the sheet reliably, taking into consideration inaccuracies of the drive mechanisms. Thus, as stated in the present application:

“More particularly, because of possible errors associated with the rotation of the feed rollers advancing print medium 12, there is a minimum reliable move amount which print medium 12 must be moved in an advance direction 18.” (Application, page 5, lines 10-12).

This can be contrasted with the teaching of Cleveland, which simply decreases the normal advance by one-half as the end of the page is approached. Since the normal advance distance in

the teaching of Cleveland will vary depending on the print mode and media being printed, Cleveland also teaches varying the advance distance at the end of a page depending upon the print mode and the type of medium being printed. In the example discussed above, Cleveland decreases the advance from 32 pixels (normal) to 16 pixels near the end of the sheet. In the discussion of printing transparencies, six-pass printing is recommended by Cleveland, with normal advance being sixteen rows (Column 18, lines 25-37). Decreasing the normal advance by one-half at the end of a transparency results in an advance of eight rows when the end of page is approached for printing transparencies. When the distance remaining at the end of the page is insufficient to advance one-half the normal advance distance, Cleveland teaches stopping any further advance, and completing printing without advancing the sheet.

Clearly, Cleveland teaches that at the end of the media, media advance is changed simply to one-half of whatever the normal advance distance is for the media being printed and the print mode performed. In contrast, in accordance with the present invention recited in claims 1 and 10, the advance is decreased to a “fixed minimum reliable move amount” as the end of a page is reached. In accordance with the present invention, the media is advanced a reliable distance, but a minimum reliable distance. The media continues to advance the “fixed minimum reliable move amount” until insufficient distance remains for any further advance of a “fixed minimum reliable amount”. As compared with Cleveland, the present invention enables reliably accurate multi-pass printing nearer to the bottom of the page.

Cleveland does not even recognize that there is a minimum fixed distance that the sheet can be advanced reliably. Cleveland merely decreases the advance distance to one-half of the normal advance distance for the operation being performed, which is not a fixed, but instead a variable distance. This advance distance in all likelihood and practicality is substantially more

than the fixed minimum reliable move amount of the typical printer. Thus, normal multi-pass printing is not performed as near to the end of the sheet as in the present invention.

Applicants respectfully submit that the Examiner is reading more into the teaching of Cleveland than is actually taught by Cleveland. In the section of the present office action subtitled "Response To Arguments", the Examiner states that the Applicants must more clearly specify "minimum reliable move amount" so as to differentiate over the "smaller steps" disclosed by Cleveland. It is respectfully submitted that claims 1 and 10 as amended in the last amendment provide such a distinction.

Specifically, in contrast to the teaching of Cleveland, claim 1 as amended recites in part:

... said printer having a minimum distance the print medium must be moved ... to overcome advancement errors associated with equipment for advancing the medium, to thereby move the medium a reliable distance, said method of printing comprising the steps of:

...;

determining an end of printable area ...;

advancing the print medium ... a fixed minimum reliable move amount ...,... equal to said minimum distance and less than said predetermined amount; and

printing on the print medium with the printhead in an area corresponding to said minimum reliable move amount during a second printing step.

In further contrast to the teaching of Cleveland, claim 10 as amended recites in part:

A method of printing ... in an ink jet printer having a minimum distance the print medium must be moved ... to overcome advancement errors associated with equipment in the printer for advancing the medium, to thereby move the medium a reliable distance, ...;

printing ...;

determining an end of printable area ...; and

printing ... using adjusted multiple pass printing, ... including the repetitive substeps of:

advancing the print medium ... a fixed minimum reliable move amount ...equal to said minimum distance and less than said predetermined amount; and

printing ... in an area corresponding to said minimum reliable move amount during a second printing step.

Applicants respectfully submit that the invention recited in claims 1 and 10 is neither taught nor suggested by Cleveland and includes advantages over the prior art.

The present invention recited in claims 1 and 10 provides a method of printing in which the print medium is advanced a predetermined distance in successive repetitive steps, until an end of print area is determined. Thereafter, the print medium is advanced in successive repetitive steps for a distance less than the fixed distance and equal to the minimum distance that the sheet can be moved reliably. In contrast, Cleveland merely discloses reducing the advance distance by one-half, which is an arbitrary distance depending on the printing mode in use. The “smaller step” disclosed by Cleveland is not related to the physical capability of the printer to advance the sheet reliably, it is merely a 50% reduction in the advance distance that would otherwise occur.

Cleveland does not even recognize that a minimum distance exists, instead recognizing only that if the full advance distance is used print registration errors can occur. Thus, Applicants respectfully submit that Cleveland has only recognized the problem addressed by the present invention, Cleveland does not suggest the solution of the present invention. Cleveland simply determines that the solution is to move the sheet by one-half the normal advance distance as the end of a page is approached. Since the normal advance distance can vary depending on the print mode and the media being printed, Cleveland would vary the advance at the end of the page depending upon the print mode and the type of medium being printed. In contrast, the present invention uses a fixed distance, the minimum reliable move amount which is determined by the physical capabilities of the machine, not by the print mode being practiced. Thus, Applicants decreased advance distance at the end of the page is related to the capability of the machine to

advance the page. Cleveland's adjusted advance distance (i.e. the "smaller step" of Cleveland) is related to the print mode or method of printing.

It is respectfully submitted that the teaching of Cleveland does not suggest in any way the existence of a minimum reliable move amount or adjustment of the printing process at the end of a page utilizing a minimum reliable move amount. While the Examiner has suggested that such is "inherent", it is respectfully submitted that the features of the pending claims can not be inherent from the teaching of Cleveland when all that Cleveland teaches is to decrease the normal advance amount by one-half. In short, Cleveland adjusts the advance distance dependent upon the normal advance distance, whereas Applicants adjust the advance distance based upon the capability of the printing device to advance the print media reliably. Clearly, the minimum reliable move amount defined in the present application and recited in the claims is different than Cleveland's teaching to simply decrease the advance amount by one half.

Thus, Applicants respectfully submit that independent claims 1 and 10 recite an invention not taught by Cleveland and should be allowed. Claims 2 and 7-9 depend from claim 1 and include all of the limitations thereof while adding further specificity to the invention recited therein. Applicants thereby respectfully submit that claims 2 and 7-9 are also allowable.

Claims 11 and 14 depend from claim 10 and therefore include all of the limitations thereof while adding further specificity to the invention recited therein. Since claim 10 is believed to be allowable for the reasons stated above, Applicants are of the belief that claims 11 and 14 are also allowable.

D. Summary of Distinctions Between Applicants' "minimum reliable move amount" and the Teaching in Cleveland of "smaller steps".

The Examiner has stated a position that “applicant must more clearly specify ‘minimum reliable move amount’ so as to differentiate over the ‘smaller steps’ disclosed by Cleveland.” As discussed above, Applicants are of the opinion that the recitations of claims 1 and 10 include such distinctions. As recited in claims 1 and 10, and explained in the Detailed Description Of The Invention, these distinctions include:

1. The “minimum reliable move amount” of the present invention is fixed. The “smaller steps” of Cleveland vary, dependent on the printing mode.
2. The “minimum reliable move amount” of the present invention is determined by the capability of the printing device to advance a sheet reliably. The “smaller steps” of Cleveland are determined from the normal advance distance, as a 50% reduction in the normal advance distance, regardless of the capability of the machine to advance the sheet reliably.
3. The “minimum reliable move amount” is a minimum distance that the sheet must be advanced in order to overcome errors in advancement that are inherent in the operation of the media transport equipment. The “smaller steps” of Cleveland do not recognize any required minimum distance, only a desire to reduce the advancement distance to continue multi-pass printing closer to the end of a sheet.
4. Simply stated, claims 1 and 10 recite advancing the sheet no more than absolutely necessary to advance it reliably. Cleveland teaches simply advancing the sheet a distance less than normal.

By using the “fixed minimum reliable move amount”, the present invention enables the use of reliable multi-pass printing as near as possible to the end of the sheet. While the “smaller steps” of Cleveland may increase the area for reliable multi-pass printing, the present invention maximizes the area of reliable multi-pass printing.

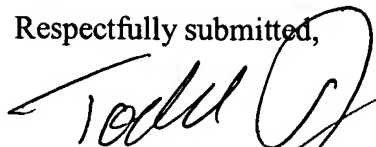
Conclusion

For the foregoing reasons, Applicants submit that no combination of the cited references teaches, discloses or suggests the subject matter of the amended claims. The pending claims are therefore in condition for allowance, and Applicants respectfully request withdrawal of all rejections and allowance of the claims.

In the event Applicants have overlooked the need for an extension of time, an additional extension of time, payment of fee, or additional payment of fee, Applicants hereby conditionally petition therefor and authorize that any charges be made to Deposit Account No. 20-0095, TAYLOR & AUST, P.C.

Should any question concerning any of the foregoing arise, the Examiner is invited to telephone the undersigned at (260) 897-3400.

Respectfully submitted,



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